Caminos

Newsletter of the Pan American Institute of Highways

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Something to Celebrate!

It seems like only yesterday when the Pan American Institute of Highways (PIH) started to work on a dream to create a technology transfer (T^2) network for the Americas. Since its humble beginning, the network has grown to become the largest T^2 networks in the world consisting of 90 centers in 22 countries. This dream became a reality because of the effort and hard work of a few committed people. From the beginning, they believed in the network and its purpose while demonstrating this in their consistent and diligent work for the network. To these individuals and the entire network, I extend a hearty thanks and congratulations for making this dream a reality!

Now, let me give you some insight on the content of this edition of the newsletter, which will focus on pavements. There have been a lot of technological accomplishments in this field. Specifically in software design and testing methods. “Rigid Pavement Design Software” is considered a very valuable tool in pavement design, and was developed by AASHTO, NCHRP and LTPP.

“HDM4–The New Generation,” talks about the features of this trend setting software, which is available for designers, planners and decision makers for pavements.

The Federal Highway Administration (FHWA) has advanced in the last several years in its research on concrete, specifically in the area of concrete expansion and contraction. The use of LTTP data and research has developed a new procedure in which “T-coeff” is no longer estimated and a more precise coefficient can be obtained.

In our PIH Corporate Sponsor Corner, we feature Troxler Laboratories Inc., an international firm with materials testing solutions and in the Certified Centers Corner, the center in Minas Gerais is run by Ms. Marcia Fátima de Almeida Rodrigues Chagas.

The headquarters of the Pan American Institute of Highways is proud to announce that PIH website (www.pih-ipc.org) will soon have a new look. It will no longer be difficult to find the information on our page web. One of the most important changes is the creation of a section on the page that is devoted to the initiatives of the PIH headquarters and our technology transfer programs. Also the creation of a new section dedicated to PIH documents. The PIH centers should be able to contribute documents to this section. We hope it will quickly grow during the first year of service. So, please keep a close eye for these changes.

Enjoy this edition!

Inside . . .

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Caminos is intended to transmit both innovative and traditional technology. It is produced by the Headquarters of the Pan American Institute of Highways (PIH) and located at the Office of International Programs. Comments and address changes should be sent to PIH at the address above.

Caminos is distributed to PIH centers, to FHWA's Washington Headquarters and field offices, the transportation community in the Americas, and agencies having direct involvement with highway technology transfer.

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HDM-4 The New Generation

In the last twenty years, the pavement management systems have improved significantly due to the advances in computer technologies. Today, highway administrators have a series of tools or mechanisms that allow them to make a better use of the available resources for the maintenance and the rehabilitation of the highways. One of the most complete analysis tools available is the HDM-4. The Highway Development and Management Model (HDM-4) is a support system for decision making for highway administrators and technicians to predict the economic, social, and environmental impacts that they might occur when making investment decisions.

The HDM-4 was developed as part of the International Study of Highway Development and Management Tools," (ISOHDM) an international project to develop new mechanisms and tools for investment analysis. This project was sponsored by the World Bank, PIARC, the Department of International Development of the United Kingdom, the Asian Development Bank, and the Swedish National Roads Administration among others.

Compared with its predecessor HDM-III, the new HDM-4 embraces a larger range of necessities of the transportation agencies, international financing institutions, consultants, and research institutes. HDM-4 has been achieved through the development of independent tools to carry out the following functions:

- Strategic planning
- Development of work plans
- Project preparation
- Research and policy studies

The technology in HDM-4 is modular. This way it can integrate with other pavement management systems in the future. Its development included three stages: (1) knowledge and algorithms incorporated in the model for the behavior of the roadway infrastructure, (2) procedures and programming modules, and the final version of the application.

The architecture of the system includes a database that stores the data and it analyzes the results, the architecture allows for graphical interfaces among the different applications, and controls the flow of the data. On the other hand, the mathematical and logical models and the algorithms for the different analysis levels are integrated in a series of mechanisms that control in the system the applications.

The main modules that are used in the HDM-4 to predict future behavior and costs of the highway systems and fleet vehicles are:

- Traffic
- Type of pavements
- Deteriorations measures of the roads
- Impact of the work
- Impact in the users
- Social and environmental effects

The HDM-4 also offers the user flexible reports that allow the user to generate reports both printed and in electronic form.

The HDM-4 is one of the most complete models for evaluating investments in highways. However, it is important to keep in mind that to implement this system significant effort of calibration and verification is needed. As it happens with any

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FHWA Develops New Method of Testing Concrete

In their search for better highways, researchers at the FHWA have developed a precise method for determining the rate at which Portland Cement Concrete (PCC) contracts and expands during temperature changes. The information generated by this new method will lead to longer lasting, smoother roads.

About half of the roads on the 69,000-kilometer (43,000-mile) Interstate system are composed of concrete or a combination of asphalt and concrete. The new test method provides a means of characterizing concrete that will significantly improve the pavement design process by better matching pavement to its environment.

"This kind of application-oriented research is part of our commitment to providing Americans with the safest, most efficient transportation system in the world," said Kenneth R. Wykle, former FHWA Administrator. "Our new testing procedure will take the guesswork out of one of the most critical elements of PCC pavement design, enabling engineers to fine-tune the process at the outset to significantly improve roads."

The thermal coefficient of expansion (T-coeff), the rate at which concrete contracts and expands as temperature changes, is a critical factor in pavement design. The new method determines the T-coeff by precisely measuring the change in length of a concrete sample when it is heated and cooled. The capability for testing the T-coeff has been around for some time, but this new procedure makes it easier to collect the data, requires little additional equipment, and most importantly, standardizes the process.

Before FHWA's new testing procedures, pavement designers usually relied on an average value to estimate the T-coeff of PCC. Using an average value left the design process vulnerable to incorrect assumptions about a specific pavement's response to temperature changes. This increased the potential for producing pavements that would develop bumps, cracks, and other surface irregularities after construction.

The new test method, which includes new testing equipment, was recently approved by the American Association of State Highway and Transportation Officials (AASHTO) as test number TP60-00, "Standard Test Method for the Coefficient of Thermal Expansion of Hydraulic Cement Concrete." It is included in the 2000 edition of the AASHTO Provisional Standards.

The PCC Pavement Team researchers who developed the test at TFHRC are also using the test in-house to measure the T-coeff of concrete pavement cores from around the country. This data will be included in the Long Term Pavement Performance (LTPP) database so that it can be used to help analyze current pavement performance, as well as design better pavements in the future.

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HDM-4 The New Generation

program, the quality of the results is highly related with the precision and the availability of updated information. Therefore, the system should be implemented as part of an overall system for the administration of highways that includes procedures and tools for the gathering of data, quality control, financing and execution of the projects among other functions. The biggest contribution in the model perhaps is not the final result of the analysis, but understanding of the complex analysis of all the data. For this reason, the HDM-4 has been definitively a significant advance in the field of the administration of highways.

It is not the intention of this article to evaluate the HDM-4, but to present the basic information about the possibilities of the model. Detailed information can be obtained in the PIARC web page: hdm4.piarc.org or contacting the Secretary of the Project PIARC ISOHDM: piarc.hdm4@attglobal.net

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Rigid Pavement Design Software

Improved guidelines for designing Portland Cement Concrete (PCC) pavements were developed under National Cooperative Highway Research Program (NCHRP) and were validated by Long Term Pavement Performance (LTPP) data. Subsequently, these procedures were adopted by the American Association of State Highway and Transportation Officials (AASHTO) and published in the *1998 Supplement to the AASHTO Guide for Design of Pavement Structures, Part II -Rigid Pavement Design & Rigid Pavement Joint Design*. Design improvements incorporated in the supplement include improved sub-grade k-value selection criteria, consideration of curling and warping, joint spacing design, consideration of slab/base friction, and faulting and corner break prediction.

To help highway managers and engineers implement this improved design procedure, LTPP developed a software program called "Rigid Pavement Design Software." The software allows the engineer to tailor the rigid pavement design to the site-specific conditions, materials, traffic, and design details. The resulting design is more cost effective and reliable and is intended to be used in concert with DARwin (the computerized version of the AASHTO '93 Guide) as an interim tool.

What Is Rigid Pavement Design Software?

"Rigid Pavement Design Software" is a Microsoft Excel spreadsheet that automates the design and analysis procedures in the 1998 AASHTO supplement. The spreadsheet includes separate tables for determining accumulated traffic loadings, seasonally adjusted k-values, depth to rigid layer, and performing corner break and faulting checks.

Who Can Benefit From Rigid Pavement Design Software?

The principal stakeholders and contributors to the LTPP project the State and provincial highway agencies will benefit most directly and immediately from the Rigid Pavement Design Software. The improved design guidelines will help answer key questions not previously addressed previously in design procedures, such as:

- How do I adequately characterize the sub-grade support?
- What is the best base type for the conditions?
- What is the optimum joint spacing?
- Will this pavement fault or have corner breaks?

Rigid Pavement Design Software Features

The Rigid Pavement Design Software features four new or modified design inputs that are not available in DARwin. These include:

- Sub-grade support.
- Joint spacing.
- Slab/sub-base friction.
- Temperature differential through out slab

The sub-grade support input is characterized by the effective (seasonally adjusted) elastic k- value of the sub-grade, rather than the "composite" k-value of the sub-grade/ base system.

After starting the program, the user inputs concrete properties, base properties, reliability and standard deviation, climatic properties, sub-grade k-value, design equivalent single-axle loads (ESALs), pavement type, joint spacing, and edge support via the input screen. This screen serves as the program's "home base" from which tables are referenced and computations are made.

In some cases, the designer must make an educated guess as to the final design thickness. Should this estimate vary significantly from the design output, a revised estimate is used and the design is re-computed.

The new Rigid Pavement Design Software also features a sensitivity analysis capability. This feature allows the user to perform "What happens if..." scenarios to determine, for example, the best base material for a fixed joint spacing, or the optimum joint spacing for a fixed base type. Design parameters that can be analyzed using the sensitivity analysis feature include modulus of rupture, elastic modulus of slab or base, base thickness, k- value, joint spacing, reliability, and standard deviation.

Rigid Pavement Design Software System Requirements

Rigid Design Pavement Software can be used on any IBM PC running Microsoft Office 95 or 97 or Microsoft Excel 7.0.

For More Information

The Rigid Pavement Design Software can be downloaded from FHWA's LTPP website (http://www.tfhrc.gov).

Recent PIH Activities

PROVIAL of Chile (La Serena)

From November 6 – 10, 2000, the National Roads Agency in Chile organized the 5th PROVIAL of Chile 2000. The title of the PROVIAL was "The New Era in Maintenance". Participating in the event were representatives from the Ministry of public works, local, regional, university authorities, and international experts as well as a representative from the FHWA who made a presentation on SUPERPAVE. A large number of professionals and university students attended the event, which was co-sponsored by the Pan American Institute of Highways, which participated with an exhibit with products and documentation. From the PIH headquarters Ms. Mónica Zurita and Mr. Antonio Nieves Torres, Executive Director participated in the event.

Seventh Meeting of the Executive Committee of the IPC

Under the setting of the great Panama channel the PIH held it's 7th meeting of the Executive Committee on November 14-15, 2000, in Panama City at the Technological University of Panama. The Dean of the Civil Engineering department Obdulia de Guizado and professor Ivet Anguizola (PIH Center Director) coordinated and participated in the meeting. Mr. Hector Montemayor, Rector of the Technological University of Panama provided the welcoming remarks to the members of the committee, which initiated the proceedings.

The PIH Executive Committee attendees were: Ervin Poka, Otoniel Fernández, Adolfo Sanz, Thais Helena Monteiro Penteado, Enrique Dahlhaus, Julia Rafael, and the President of the Executive Committee, Julio C. Caballero. Also in attendance from the PIH headquarters were Antonio Nieves Torres (Executive Director), King W. Gee (Director General), Enrique Ordóñez (Operations Manager), and Mónica Zurita (Operations Assistant). The PIH headquarters presented an activities report for the year 2000 and a special project. The project consisted in the modification of the PIH By-Laws. As a follow-up to the meeting held in Miami, Florida, in 1998, Mr. Otoniel Fernández, Ms. Thais Helena Monteiro Penteado, and Mr. Enrique Dahlhaus provided several presentations in reference to the results obtained from by the different working groups.

Caribbean Activities

In the Caribbean region, the PIH headquarters has continued to work with the Caribbean islands of Belize, Trinidad &Tobago, Jamaica, Barbados, and St. Lucia in the development of a regional network system. In January, meetings were held with the University of the West Indies in Trinidad (UWI) to develop the strategic plan for the implementation of the PIH Caribbean Initiative. In this initiative the UWI would function, as the regional coordinating center and the PIH Headquarters would perform the duties as the lead organization and master-clearing house. A needs analysis would be developed and distribute to the island's Ministry of Works Agencies to assess the greatest technical and training needs for the Caribbean region. The next steps for the PIH and UWI will be to analyze the findings and coordinate a regional meeting with all the participants to discuss the results, and develop an official agreement.

In July 2000, the National Works Agency (NWA) in Kingston, Jamaica joined the PIH network with the aspiration of developing a certified technology transfer center. The center's director is Mr. Ivan Anderson, Chief Executive Officer (NWA); Manager, Mr. Patrick Rose, Director, Planning and Research and center coordinator is Ms. Cheryl Hawkins. The NWA has been developed as part of the government's public sector modernization project. NWA is the agency that will have the responsibilities for road planning, construction, maintenance, sea defense and training. NWA has begun the steps for the development of a technical reference library and purchasing office equipment, for the center. At this time, we would like to welcome the NWA and the T ^{2} center staff to the PIH network.

PIH Certified Centers Corner

Department of Highways, Institute of Roads of the State of Minas Gerais, Brazil

The Pan American Institute of Highways, Minas Gerais' (IPC/MG) center is located in Bello Horizonte, Minas Gerais, Brazil and is linked to the Department of Highways, Institute of Roads of Minas, Gerais (DER/M). The center joined the Pan American Institute of Highway's (PIH) network in 1992 and obtained center certification in the network during 1993.

IPC/MG uses the structure of DER/MG especially in the Service of Selection and Training (SST). This service provides training to specialists by usage of video and audio training equipment, data shows, computers and access to the INTERNET.

Under DER/M, the center performs the following activities:

- Organize seminars and training courses for engineers of the department which are also opened to professionals from other transport organizations.
- Publish a technical magazine, "Vias Gerais" which is directed to areas of concessions of highways, projects, construction, maintenance and conservation of highways.
- Collaborate with the PIH Headquarters Office to distribute Vias Gerais to the network.

In the last years, some factors have contributed to a decrease of the technology transfer activities for IPC/MG, basically those factors of financial order. The legal impossibilities did not allow the center to administer the monetary resources from the training activities and reapply them to the center's programs.

IPC/MG has worked with the PIH network in vital activities that have been very positive. They participated n the Loaned Staff Program during 1996 and 1998. The impact of the activities with the network has allowed a number of professionals to participate in training courses, seminar programs and to share technical information and expertise with other centers within the Brazilian network.

The IPC/MG center looks forward to future efforts and aspire to exposure within the PIH network to local authorities and customers in the United States.

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PIH Corporate Sponsors Profile

Troxler Electronic Laboratories, Inc.

Troxler Electronic Laboratories, Inc. is a worldwide leader in the development and manufacture of quality control measurement equipment for the construction industry. All of Troxler's equipment meets or exceeds ASTM and AASHTO standards. William F. Troxler founded the company in 1958. Today there are ten branch sales/service centers in the United States, Canada and Germany, in addition to the headquarters in Research Triangle Park, North Carolina, and over 50 international distributors worldwide.

Troxler is known worldwide as the manufacturer of the nuclear moisture/density gauges that measure the density of soil, aggregate, asphalt, and concrete materials. Troxler developed the Superpave Gyratory Compactor, used for asphalt mix design, in conjunction with the Federal Highways Administration and the Strategic Highway Research Program. Troxler conducts one-day courses for gauge safety certification and Radiation Safety Officer certification.

The international sales department ensures that all of the distributors worldwide have the support, training, and, the equipment necessary to assist the customers in their area.

As one of the Corporate Sponsors for the Pan American Institute of Highways (PIH), Troxler plans to become more active and visible in the PIH activities. For more information visit their website at www.troxlerlabs.com.

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